Boulder Amateur Television Club
TV Repeater's REPEATER
Febuary, 2021

BATVC web site: www.kh6htv.com

ATN web site: www.atn-tv.com

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ARRL Statement of the Purpose of Amateur Radio

For over 100 years amateur radio and ARRL -- the National Association for Amateur Radio® -- have stood for the development of the science and art of communications, public service, and the enhancement of international goodwill. Amateur Radio's long history and service to the public has solidified the well-earned reputation that "Amateur Radio saves lives."

Amateur Radio Operators, due to their history of public service, their training, and the requirement that they be licensed by the FCC have earned their status as a component of critical communications infrastructure and as a reliable resource "when all else fails."

Amateur Radio is about development of communications and responsible public service. Its misuse is inconsistent with its history of service and its statutory charter. ARRL does not support its misuse for purposes inconsistent with these values and purposes.

Editorial Comment: The above statement from the ARRL was recently sent out to all members via e-mail. I am troubled by the words in the last paragraph about "*Misuse*". I hope I am wrong in "reading between the lines", that in some way this means that ham radio was used in coordinating the violent insurrection and assualt upon our nation's capital on January 6th. However, I do know I saw videos and photos of some of the insurrectionists wearing military style body armor and 2 way radios that looked a lot like ham HTs. I also have heard very inflammatory conversations on the ham HF bands, especially on 80 meters. I am active on 20 meters SSTV, and have recently seen some very disturbing SSTV images appear on my computer screen. I agree with the ARRL and hope that our country heals soon and these problems and trouble makers disappear. However, we need to vigilant and if we find this happening on our ham bands, report them to the authorites.

Jim, KH6HTV

Further evidence of this possibility appeared on the USA Today web site on 1/20 with the headline --- ***FCC warns extremists are turning to radio to plan attacks after being banned from social media***. --- The FCC on the 17th of January issued an FCC Enforcement Advisory, DA-21-73A1 with the title: **WARNING: AMATEUR AND PERSONAL RADIO SERVICES LICENSEES AND OPERATORS MAY NOT USE RADIO EQUIPMENT TO COMMIT OR FACILITATE CRIMINAL ACTS**

BCARES Zoom Meeting

EC, Allen, K0ARK

Boulder OEM Director, Mike Chard

BCARES Annual Meeting:

The annual meeting of the Boulder County Amateur Radio Emergency Service (BCARES) was held on Jan. 18th. Due to covid pandemic, it was an on-line Zoom meeting. The meeting was hosted by the chairman & EC, Allen Bishop, K0ARK. There were 23 members in attendance.

Mike Chard, the director of the OEM, opened the meeting by thanking BCARES for our service to the citizens of Boulder. He discussed the major events of the past year, covid being the biggest. He also told us about changes being made in the EOC, including new IT equipment replacing old obsolete gear and the change from Web-EOC to a Microsoft product.

EC, Allen talked about the main events of the past year. The major event was the Cal-Wood forest fire, this past fall. Because of covid and the age of many of our members, we were not called upon for some other incidents. He also said that because BCARES had transitioned to all digital ATV, that we had donated all of our old analog TV gear to the Adams County ARES group. Allen asked Pete, WB2DVS, to talk briefly about the new microwave IP linking project. It will use the Rocky Mountain Ham (*www.rmham.org*) group's microwave network. Allen also reminised about some of the things BCARES has done in the past. Allen said BCARES has been serving Boulder for 42 years. Looking to 2021, Allen said a major goal is to recruit new, younger hams into BCARES. The majority of the existing membership is getting old and graying and we desperately need new blood in the organization.

The meeting was broadcast to Boulder county over the W0BTV TV repeater and also then streamed over the internet via the BATC. One of the major purposes of our ATV repeater is to support BCARES and the OEM. Many BATVC members are quite active in BCARES. Pete, WB2DVS, has been the equipment officer in charge of maintaining all of BCARES equipment for at least the past 25 years. Doshia, WB2NAS, was elected to the Board of Directors. Both Bill, ABOMY, and Bill, KD0YYY were elected as alternates to the Board. The other director elected was Rick, KK0COP. Rick is a new ham, but brings over 40 years of law enforcement experience, many as a police chief, to the board.

USB TV TUNER DONGLES - contd:

The article on making USB TV tuner dongles work with Windows 10 definitely generated interest. Jack, K0HEH, has asked will they work on 23cm ? To be honest, I had not tried them there, just on 70cm band. So, I tried them on my Windows-10 PC and on both 33cm and 23cm bands and the answer is **NO** ! However, consulting with Bill, AB0MY, he says they will not work on 33cm and 23cm bands with Windows, but will work with Linux computers. But it does take a special patch code to alter the kernel in the driver. Bill is using them on 23cm on both a regular Linux computer and a Raspberry-Pi. With the Windows driver, the dongles will only tune TV signals up to 862 MHz. With Linux, they should work up to 1.75 GHz.

Also, I found that not all dongles will work. In my most recent test, I dug up several dongles and tried them. 3 out of 4 worked on 70cm DVB-T / 6MHz. They were: RTL-SDR.com, NooElec, and a generic no brand one. The one that did not work was labeled WandTV. 73 de Jim, KH6HTV

VE3IRR - DVB-T with BladeRF & USB Dongles

Bill, ABOMY, also gave us a lead to where he found the patch code for Linux. It was VE3IRR, Clayton's web site: https://irrational.net/2014/03/02/digital-atv/ This site is recommended reading to see how other hams are approaching generating and receiving DVB-T signals. Clayton is using the BladeRF SDR transceiver running the latest version of GNU Radio. So if you are a real computer hacker and love code, etc. you

will no doubt find Clayton's site of interest. Otherwise, if you are an appliance operator, and want the simple, easy way out, then simply stick with the Hi-Des gear.

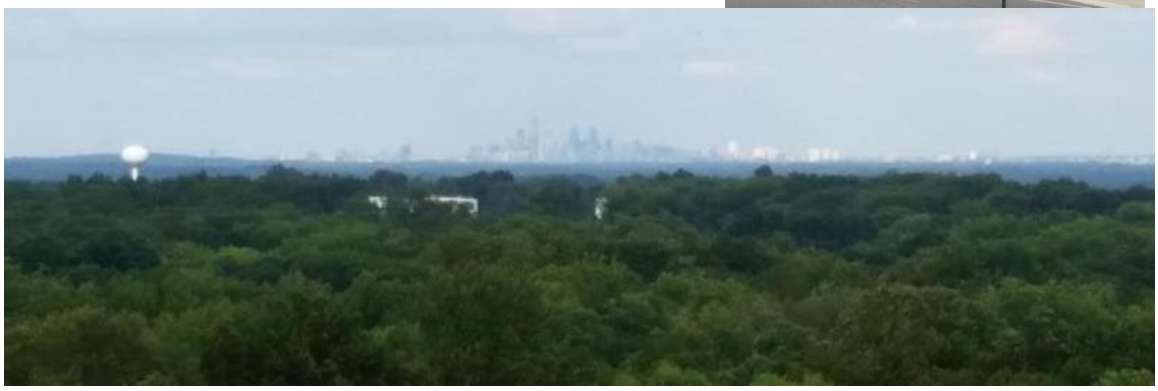
KC3AM - ATV REPEATER: from Dave, KC3AM's QRZ page

(TNX to Larry for the lead --- "Hey, Jim -- I was just perusing something on QRZ and found these pictures of a dog that likes to do antenna climbing. His owner, Dave, KC3AM, bought one of your amps. See at: https://www.qrz.com/db/KC3AM

73 de Larry, K0PYX)

I am active on ATV from home & mobile and help maintain the area ATV repeaters. The Wilmington, Delaware ATV repeater is, 439.250 MHz AM input and 423.0 MHz DVB-T Digital output at 2 MHz bandwidth. The Delaware County PA ATV repeater is 439.250 MHz AM input and 421.250 MHz AM output. I am working on a complete DVB-T repeater for the Wilmington site as funds permit.

This is the site I have for my KC3AM-ATV repeater in Wilmington Delaware. It is the highest point in Delaware at 440' ASL. There are 134 steps to the top which I have climbed many, many times, resting at the 2nd & 4th levels. Three times in one day is my record. Carrying stuff up just makes it worse. Here is a link to the tower history, https://www.towerspace.net/history/

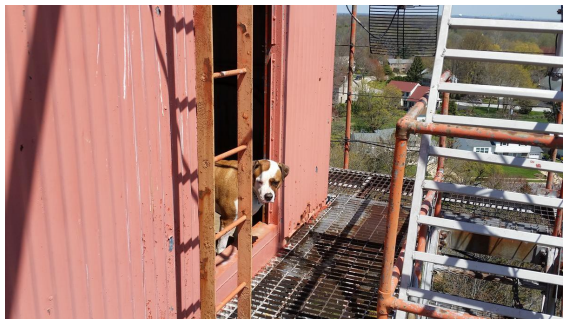


The Philadelphia skyline about 30 miles away.

The left monitor is the DATV-Express 1.285 GHz, DVB-S, 6 watt signal received at my house 3 1/2 miles away. This passes through the dirt about 1/2 mile from my house. I am using a can antenna on the roof at home with no pre amp and a Comet Vertical at the site. The right monitor is a Comtech board on 1.255 GHz, FM, 20 watt signal from 18 miles away just going through trees and using an 18 element loop yagi, no pre amp and a Comet Vertical at the site.

This was my first attempt at DVB-T with a HiDes TX and KH6HTV 60 watt amp from my house to the site. I was very suprised and happy that it worked. 438.0 MHz, home made Rib Cage, Downeast Pre Amp, DCI filter.

Vince, N3BFZ, DVB-T 18 miles away on 438.0 MHz. His 439.25 AM signal is about a P2 on a good day.



Now for the faint of heart. --- This is Maya at 90' looking around and then looking out at me from the building topside. Looking at the tower picture the 90' point is the last landing just below the building topside.

NO, I did not bring her up there. A dogs loyalty brought her up there. For her safety I do not bring her to the site when I am climbing topside any more, but maybe if I could get her to wear saddle bags? Dave, KC3AM

ANTENNA RANGE FEEDBACK:

As always- thanks Jim. I really enjoyed the dish feed measurements. Dale, W4OP

Jim --- Thanks. Enjoyed your antenna measurements. It is very difficult to get gain measurement using a dipole as a gain reference, as it responds to a multitude of reflection at the site. It is even difficult to use a dipole in an anechoic chamber. That is why they developed standard gain horns: Gains of 15 and 24 dBiL, depending on frequency band.

73 Ed, K0JOY

Hi Jim -- Thanks for the newsletter. A couple of comments on antenna measurements - I suggest you read my text again:

1. A dipole is a very poor reference antenna, since ground reflections give erroneous gain - up to +6 dB, and down to ?
2. The receiving antenna height should be at least four times antenna aperture (dish diameter). if I ever update the program, I will add this.

73 Paul, W1GHZ

Reply to Ed & Paul's comments about using a dipole as a reference antenna.

I used the dipole because I did not have any other real reference antenna, such as a standard gain horn as Ed suggests should be used. Thus, I reported my results referencing my own dipole as dBd, where the "d" was my own dipole's received power. So, let's try again, but this time assume that the L-Com, BBQ grill, dish antenna is the reference with it's manufacturer's gain specification of +23dBi. I will express all results now in dBi, thus adding 2.2dB to my previous table's dBd values. We would then have the following table, all in dBi. Now, where is the real truth ? The uncertainty between the choice of reference antennas was of the order of 3dB. The gains of both the dipole and 1/4 λ ground plane antennas were about 3dB too high using the L-Com reference. But the gains of both the L-Com and Radio Wave dish antennas were 3dB too low using the dipole as reference. The only real truth for me was the relative differences I saw on my own range among the various antennas. Some were poor antennas and others were great. Exact values ? ? ?

Jim, KH6HTV

ANTENNA	Gain Mfgr's Spec.	GAIN dipole Reference	GAIN L-Com BBQ Reference
L-Com model HG5822EG, BBQ grill style dish, 12" x 16" (alternate reference antenna)	23 dBi	20.2dBi	23 dBi
Radio Wave model FP1-2-5NS, 12" dish	23 dBi	19.9dBi	22.7dBi
ValuLine VHLP1-220-W01, 12" dish with carbon foam side-lobe suppression. Modified by N0YE to use a WA5VJB, 2-11GHz log-periodic antenna as the feed		15.5dBi	18.7dBi
WR-187 open flange waveguide - MicroLab/FXR model 601-D98, N coax to waveguide adapter		5.8dBi	8.6dBi
1/2 λ Dipole (KH6HTV's reference antenna)	2.2 dBi	2.2dBi	5dBi
1/4 λ ground plane, monopole with 4 dropping radials - SMA	2.2 dBi	1.8dBi	4.6dBi
Pro 5.8G, 4 1/4" rubber duck, RP-SMA		2.6dBi	5.4dBi
NOYE 1/2 λ dipole with disc reflector		3.5dBi	6.3dBi
1 turn loop antenna on SMA		-1.1dBi	1.7dBi
WA5VJB, 2 - 11 GHz, Log-Periodic		4.2dBi	7dBi
WA5VJB, 5.8 GHz, Quad Patch	11-12 dBi	5.4dBi	8.2dBi
WA5VJB, 5 - 18 GHz, Vivaldi Gain	8 - 10 dBi	7.6dBi	10.4dBi
WA5VJB, 9 - 25 GHZ, Vivaldi Gain		1.3dBi	4.1dBi
Chinese 1.4 - 9.5 GHz, Log-Periodic		-1.2dBi	1.6dBi
Chinese 3-20 GHz, omni-directional VivaldI	3 - 5 dBi	1.3dBi	4.1dBi

CATV MODULATOR --
Modification for 434 & 426.25 MHz

Jim, KH6HTV

I have written in the past about using commercial grade, CATV modulators for generating really pure, Vestigial Side-Band TV, for ATV. My first was in the Feb. 2013 issue of QST. More recently, I discussed them here in our newsletter in the Dec. 2020, issue #65. My earliest product for KH6HTV Video back in 2011 was a 70cm, VUSB-TV transmitter which used a Pico-Macom, CATV modulator. These were modulators used by the cable TV folks in the head-ends of their cable systems. They were also used widely in closed circuit TV systems, such as in hotels, etc.

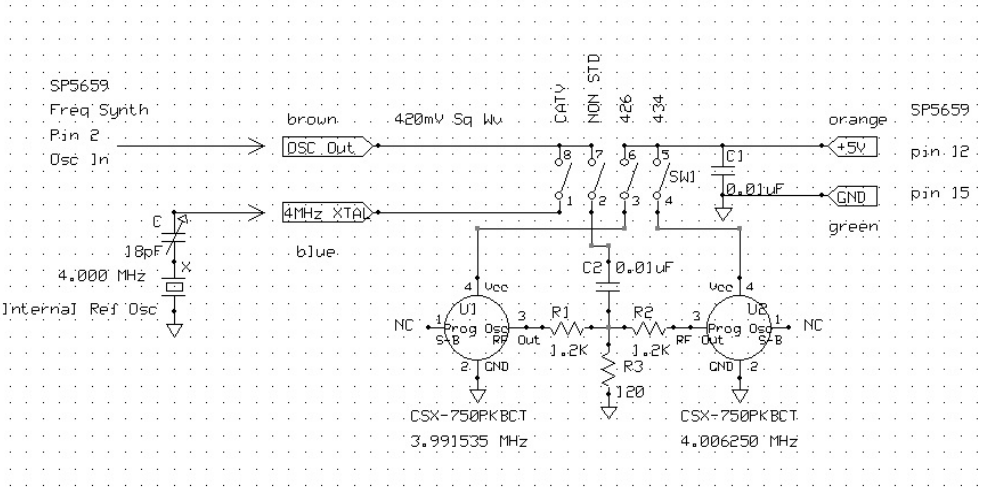
These CATV modulators are fully synthesized to work on all standard, 6 MHz, broadcast TV and also CATV channels. CATV channels 57-61 fall in the amateur 70cm band. For example channel 57 is from 420 to 426 MHz with the video carrier at 421.25 MHz.

This however poses a problem for some ATV groups in the USA that have historically chosen, non-standard frequencies for their ATV operations. Soon after I introduced my 70cm, VUSB-TV transmitter, Mike, WA6SVT, contacted me and encouraged me to also offer such transmitters with non-standard frequencies. Mike said the most commonly used, non-standard frequencies in use were #1 - 434.000 MHz and #2 - 426.250 MHz.

Thus, back in 2011, I studied the problem of how to modify a CATV modulator to work on frequencies, such as 434 or 426.25 MHz. I had previously bought several modulators from different companies, including: Pico-Macom, Holland, Drake and Blonder-Tongue. I ran exhaustive tests on these modulators to determine their overall performance. As a result I had chosen the Pico-Macom model MPCMA as the best modulator to use in my model 70-10 TV transmitter. So, I went back to all of these modulators and proceeded to open them up and carefully examine their internal circuitry to see how I might be able to alter their output frequency from the standard CATV channels. There was only one which appeared to have a simple enough frequency synthesizer circuit that could be modified easily. It was the Pico-Macom model MMA860.

The MMA860 modulator used a Zarlink SP5659 frequency synthesiser IC. The frequency reference used was a 4 MHz crystal connected to the IC's oscillator terminal. By cutting the crystal circuit trace and injecting from a signal generator a 4 MHz sine wave, and then diddling the frequency slightly, I was able to determine precisely what reference signal I would need to be able to generate either a 434 MHz or 426.25 MHz ATV signal. For 434 MHz, the reference required was 4.006250 MHz. For 426.25 MHz, the reference required was 3.991535 MHz.

I then researched where to obtain crystals for these frequencies. By then International Crystal was going out of business. But I discovered programmable cyrstal oscillators were available from Digi-Key and Mouser. I ordered the appropriate PXOs as Citizen model CSX-750PKBCT. Digi-Key custom programs them in their warehouse.



This is the circuit I designed to build into the Pico-Macom MMA860, CATV modualator. I first built it in breadboard fashion on 0.1" perf board with copper tape. All of the components are surface mount (SMD). The switch was an IC style DIP switch. The

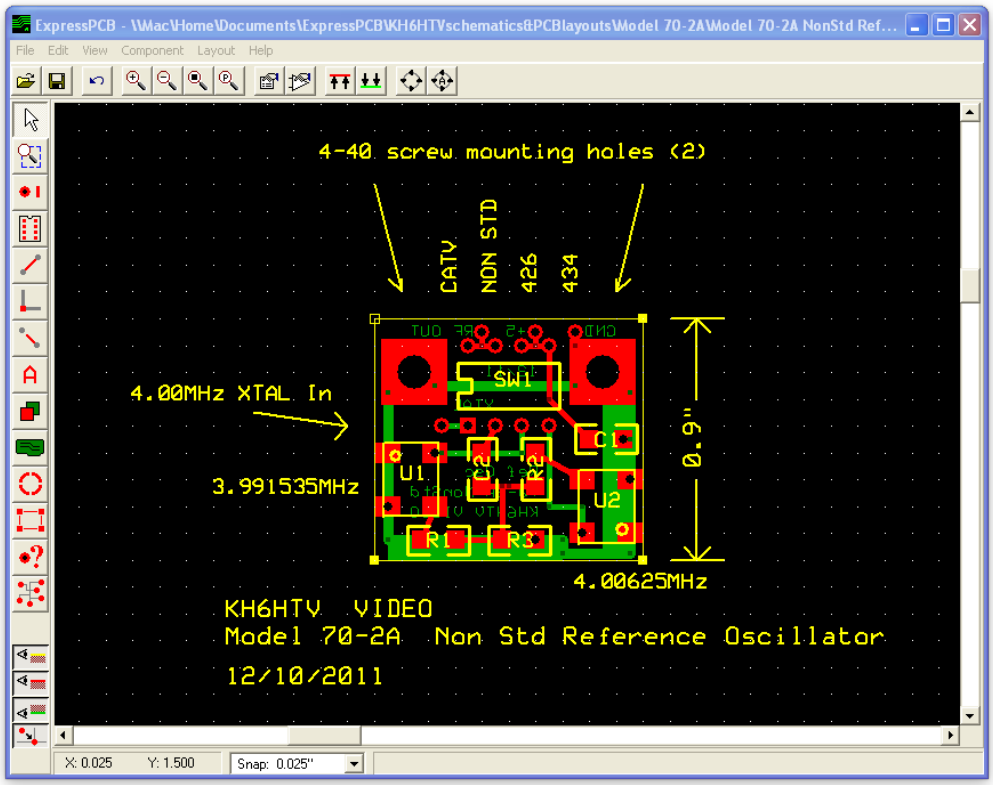
SP5659 required a 100mV(rms) drive signal, so the resistor voltage divider, R1-R3 is necessary. I then laid out a printed circuit board as shown in below photo.

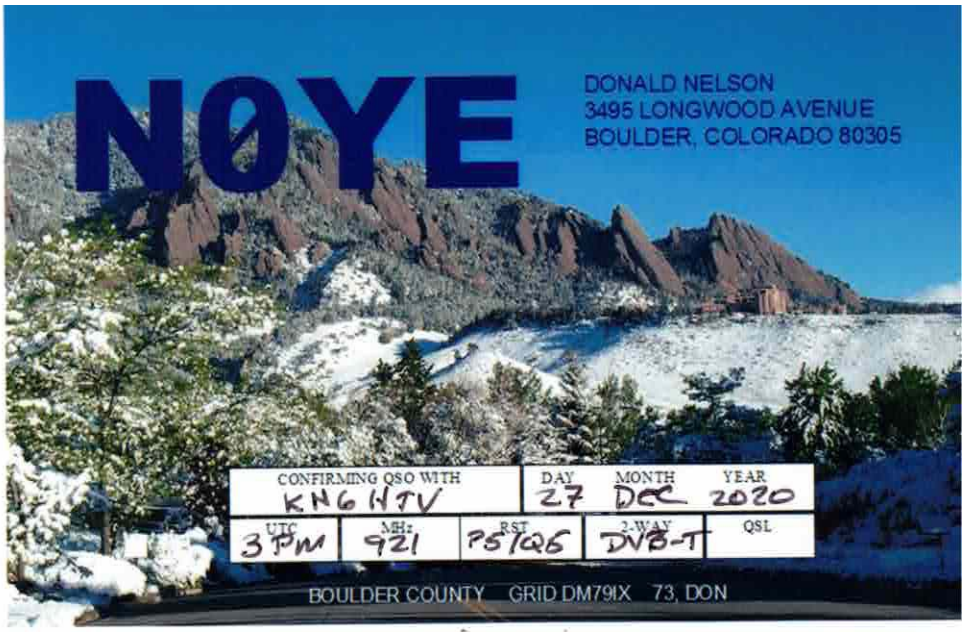
I installed this tiny pc board inside of the MMA860. I removed the side panel and cut a small rectangular hole as access to the DIP switch and drilled two holes for 4-40 screws to mount the PXO pc board on the side panel. This was done immediately over the SP5659 IC. Tiny wire-wrap wires were then used to connect the PXO board to the main modulator board.

Depending upon the settings of the DIP switch, SW1, the modulator functioned normally with the internal 4 MHz crystal on the standard CATV channels with SW1-a closed. With SW1-a open, SW1-b closed, and either SW1-c or SW1-d closed, a PXO's signal was instead injected into the SP5659 synthesizer. For 426.25 MHz, the modulator's front panel control was set to Ch 58 and SW-1c was closed. For 434 MHz, the modulator's front panel control was set to Ch 59 and SW-1d was closed.

After coming up with this design, I then proceeded to advertise it as a product for sale. I offered to sell a modified Pico-Macom MMA860 as my model 70-2A, VUSB-TV Modulator. To be perfectly honest, sales were a bust ! I only ever sold two of them, one five years later in 2016 and one installed in a 70-10 transmitter in 2013.. So there is obviously, not a market for such a product. I have thus quit offering it for sale. But, for ATV hams out there that want to roll your own, this is how you can do it. Good Luck !

73 de Jim, KH6HTV





Worked All Bands DVB-T Marathon: With the recent announcement from the FCC about Amateur Access to 3.5GHz Band to "Sunset", Jim, KH6HTV, & Don, N0YE, decided we needed to jump in soon and make at least one DATV contact on that 9cm band. While we were at it, we then said -- "What the heck - Let's do a "Worked All DATV Bands" while we are at it. Thus the goal was set to do simplex, DVB-T, 2 way, QSOs on 70cm, 33cm, 23cm, 13cm, 9cm, 5cm & 3cm bands while we were at it. To be perfectly honest, the only really new bands for us were 33cm & 9cm, but we did them all this time. On microwaves, we have worked many simplex DVB-T contacts on both 5cm & 3cm bands from many different locations. The objective this time was not to work long distances, but simply to work all bands. All of the contacts for this worked all bands were made over similar 5 mile paths. Don operated either from his QTH in south Boulder or from the parking lot at NCAR and Jim setting up his gear in his backyard, south-east of Boulder. The 3cm contact scored was between Flagstaff mtn. & Legionaire's hill. The last required contact was made on 921 MHz on December 27th.

For Don, he already had most everything he needed. Over the years he had built a lot of microwave transverters for SSB. It mainly meant pulling them off the shelf, blowing off the dust, and making minor mods to use his Hi-Des DVB-T modulator and receiver as the IF rig instead of his 2m/70cm SSB transceiver. For Jim, it meant a bit more work as he had to start from scratch on some bands.

70cm & 23cm: For these bands we used our normal equipment which we use all the time for our ATV QSOs via the W0BTV repeater. 70cms (441MHz) was worked on 1 Nov. 2020. 23cm (1243MHz) was worked on 5 Nov. 2020.

33cm: For the 33cm (900 MHz) band, it was pretty straight forward as our Hi-Des gear already covers that band. It simply meant adding some kind of rf power amplifier and

suitable antennas. Jim used an RFHIC (1F7534P), CATV line amplifier to get +19dBm (rms) of DVB-T power. Jim's antenna was an L-Com, 7 element, 900MHz yagi. Don used a 6 element, home-brew yagi antenna with +24dBm of power. The major complicating factor was excessive RFI on this band. This 921MHz contact was on 27 Dec. 2020. This contact was discussed in the Jan. 2021 issue #66.

13cm: We operated on 2.393 MHz with 6 MHz bandwidth. This was in the 10MHz, ham only slot of frequency, just below the Wi-Fi band. Don used his old 2.3GHz SSB rig with 19dBm rf output power. His antenna was a 20 element, loop yagi. Jim used his Hi-Des HV-320E modulator and his HV-120A receiver directly on 2.393MHz. Jim used a converted Show-Time rf power amplifier to put out +29dBm (rms) of DVB-T. For antennas, Jim used a standard, BBQ grill, dish antennas of 23dBi gain. These 2.393MHz contacts were on 2 & 11 Sept. 2017.

9cm: Don used an existing, home-brew, 3.5GHz SSB transverter, but with a different IF in/out. Don's rig put out 30dBm of RF power. Jim had nothing for this band. Thus, for Jim's rig, Don pulled more goodies from his infinitely deep microwave closet. Don loaned Jim a California Microwave brick oscillator crytsaled for 3.920 GHz, a home-brew band-pass filter and a 12" dish antenna. Jim found enough other stuff in his ham shack to lash together a bread-board, temporary 3.4 GHz transverter. Jim's rig put out whopping +13dBm (rms) of DVB-T power and it's receive sensitivity was -93dBm.

For antennas, we both used identical dish antennas supplied by Don. They were 12" in diameter. Don has previously used them on 5cm and 3cm bands. He normally used an adjustable J shaped 0.141" semi-rigid coax feed for them. He simply removed the normal feed antenna and installed a WA5VJB log-periodic antenna as the wide-band feed.

This 3.395GHz contact was on 30 Oct. 2020. Details about this contact were documented in the Nov. 2020, issue #63, newsletter.

5cm: Again, Don used his trusty, reliable, 5 GHz, SSB transverter. Don's output power was 5dBm. Jim used his home-brew transverter which has been previously described in this BATVC newsletter (issue #57). Jim's output DVB-T output power was +23dBm (rms) and his receiver sensitivity was -99dBm. Both Don & Jim used L-Com, BBQ grill, +23dBi dish antennas. This 5.678GHz contact was on 18 Aug. 2020.

3cm: For 3cm, we both used modified, SSB transverters built by Don. Don's rf power was 18dBm and Jim's was 23dBm (rms). Don used a 12" dish antenna. Jim used an offset feed, Dish Network antenna with +28dBi gain. This 10.359GHz contact was on 10 Oct. 2019.

73 de Jim, KH6HTV

W0BTV Details: Inputs: 439.25MHz, analog NTSC, VUSB-TV; 441MHz/6MHz BW, DVB-T & 1243MHz/6MHz BW, DVB-T Output: 423MHz/6MHz BW, DVB-T, or optional 421.25MHz, analog VUSB-TV. Operational details in AN-51a Technical details in AN-53a. Available at: https://kh6htv.com/application-notes/ We hold a social ATV net on Thursday afternoon at 3 pm local Mountain time and an ATV activity night on Wednesday evenings at 7pm. ATV nets are streamed live using the British Amateur TV Club's server, via: https://batc.org.uk/live/kh6htvtvr or n0ye.

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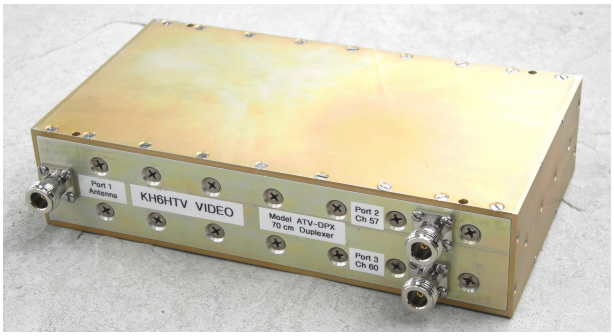
ATV HAM ADS

Free advertising space is offered here to ATV hams, ham clubs or ARES groups. List here amateur radio & TV gear **For Sale - or - Want to Buy.**

CLEARANCE SALE
70cm Band-Pass Filters & Duplexers

70 cm, 6 MHz, Band-Pass Filter



70cm, ATV / DTV Duplexer

$ 100 each

Two years ago, I found a source of both band-pass filters and duplexers for the 70cm band. I thought there would be a market for such components in Amateur TV. They should have been of interest to hams wanting to build ATV repeaters. I offered to sell them, tuned up on my network analyzer for any desired frequency in the 70cm amateur &

business bands (420 - 460 MHz). I was wrong. No sales. I am left stuck with a shelf full of these filters & duplexers. I want to unload them. I am willing to sell them at cost, plus shipping. **My price is $100 each.** They will not be tuned to any specific frequency. You will have to tune them up yourself. They will be shipped via USPS priority mail in a medium size, flat rate, carton. The shipping cost is $15.

These are quality machined items and they originally cost much more. The band-pass filter was made by Ericson as their model KRF-201. The duplexer was made by Microwave Solutions. For more details, see the detailed spec. sheets on my web site for the model ATV-BPF-XXX & model ATV-DPX. My web site is: **www.kh6htv.com**

To order, send an e-mail to: Jim, KH6HTV, at kh6htv@arrl.net

Insertion Loss, frequency responses of the 70cm, Band-Pass Filter (left) & Duplexer (right) 10dB/div. & 5MHz/div.